

THE MINERAL WATERS
OF HARROGATE

BY J. LIDDELL, M.D.



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THE
MINERAL WATERS
OF
HARROGATE.

BY

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P R E F A C E.



THE object of this little book is to provide members of the medical profession with a concise account of the constitution, action, and uses of the mineral waters of Harrogate.

In the chapter on the action of the mineral waters, I have incorporated the results of my observations on their influence upon the excretion of urea and uric acid. Though a knowledge of their action upon these urinary constituents is of primary importance, no attempt has previously been made, so far as known to me, to ascertain the nature of this action.

The value of the mineral waters and of the climate of Harrogate in the treatment of disease, is being recognised more and more every year; and to meet the increasing demand for baths, the Corporation has recently arranged to build a new suite, which they state will be unequalled in Europe, not only in their architectural features, but, which is of more importance, in the elaborateness of the bathing arrangements.

I desire to acknowledge my obligations to Dr Ralph Stockman, School of Medicine, Edinburgh, for valuable criticisms and suggestions; and to thank my brother, Mr George Liddell, M.A., Vans Dunlop Scholar, Edinburgh University, for assistance in the preparation of this book.

HARROGATE, *July* 1893.

THE MINERAL WATERS OF HARROGATE.

CHAPTER I.

HARROGATE AS A HEALTH RESORT.

WE propose to deal primarily in this little book with the mineral waters of Harrogate, but it may not be out of place to premise our remarks on this subject by a brief account of the advantages possessed by the place as a health resort.

The celebrity which Harrogate has acquired by its medicinal springs, tends to overshadow the capacities of the place as a health resort, but the advantages it enjoys in this respect are so numerous, and play so important a part in supplementing the more direct effects of the chemical springs, that no account of the latter, however brief, can afford completely to neglect these aids to the remedial properties possessed by the waters.

The first and most important question in regard to any place which lays claim to the title of a health resort, must be directed to its climate. So much is generally recognised to depend on this characteristic, that it would be mere waste of time to dwell upon its importance as an influence on the human organism. As regards climatic conditions, then, Harrogate is unusually favoured. Standing as it does on high uplands, midway between the eastern and western seas, it possesses the best qualities of the climate of both coasts, while being free from the peculiar disadvantages of each. The moisture-laden winds of the Atlantic have discharged most of their contents in their passage across the mountainous country which lies between Harrogate and the west coast, before reaching the uplands on which the town is situated, and thus the circumstances of its inland position secure to Harrogate a dryness of climate possessed by few, if any, of the other watering-places of England. For the same reasons, the east winds, of which the depressing effects are so well known to all who dwell in places exposed to them, are in great measure robbed of their peculiar bitterness in traversing the wide extent of country which stretches between Harrogate and the German Ocean. The elevated situation of the town, moreover, provides a security against the serious disadvantage incident to many places of low elevation, of having a relaxing climate, and serves to keep it provided with constant

supplies of upland air from the neighbouring moors and wolds.

The combined effect of these different causes is thus to secure a dry, fresh, invigorating atmosphere, which acts by itself as a powerful tonic on the system, strengthening and recuperating in a remarkable degree the powers of the body, and greatly aiding the more directly restorative action of the mineral waters. The remarkable purity of the air of Harrogate, its pellucid clearness, and its freshness, presenting, as these qualities do, so marked a contrast to the thick murky atmosphere of manufacturing towns, have always made the place a favourite resort with those whose occupations confine them to the industrial centres, and one can easily understand the enthusiastic terms in which those who have to spend the greater part of their time "cribb'd, cabin'd, and confin'd" in such places, speak of Harrogate and its attractions.

Situated in the centre of a region which in every direction round is occupied by the busy towns of Yorkshire and the adjacent counties, and yet removed to such a distance from the *fumum strepitumque* of these centres of trade that no sign, no trace of them is to be perceived, Harrogate would seem to be designed by nature as a place of retreat where the strained and exhausted powers of the overworked may be restored by the remedial influences of the place. Thus, by a happy combination of causes,

Harrogate holds a unique position among the sanatoriums of England. There is no place where the numerous nervous affections arising from the hurry and pressure of modern life may be more effectively dealt with, while these secondary circumstances of climate act at the same time no less beneficially on those whose ailments are of such a kind as to require the medicinal action of the mineral waters.

But while the climatic conditions are thus especially favourable, the other advantages of the place demand some notice, but may be dealt with more briefly.

The scenery in the neighbourhood is varied and diversified, and though it does not attain to grandeur, it is not devoid of many aspects of great beauty and sweetness. The landscape presents many pleasing features naturally, and much has been done by plantation to add to the attractions of the adjacent district. The country is well wooded, but not so heavily as to induce the retention of moisture in the soil and air and thus give rise to an undesirable humidity of atmosphere. The uninterrupted view over the wide sweeping uplands which may be obtained from many points of vantage in and near the town is, to the mind of the writer, one of the great attractions of Harrogate, and produces in the beholder a feeling of freedom and expansion, which to those who have been pent up in the narrow bounds of a city is one of the most pleasant sensations which can be experienced.

The descriptions of the environment of Harrogate,

which we find in early writers on the place, are difficult to reconcile with the present appearance of the country, for in every direction the eye rests on objects to please and to invite, while lovers of the picturesque will find many hidden nooks of surpassing beauty and interest. The neighbourhood provides numerous attractions, too, which it does not fall to us to describe, but which have a part to play in furnishing places of interest for excursions. In the immediate vicinity, the historical and romantic associations of Knaresboro' and its picturesque situation attract alike the antiquary, the person of literary tastes, and the lover of beautiful scenery. Many other places of interest, such as Fountains Abbey, will be found further afield.

Those, however, who are averse to making long excursions, or who are prevented by bodily weakness from seeking recreation at a distance, will find ample space for exercise in Harrogate itself. By the far-seeing wisdom of Parliament, 200 acres of land were, in the year 1770, set apart for the public use. This land, the well-known Stray of Harrogate, encircles the town as if with a broad girdle of meadow, and provides visitors with a field for recreation at their very doors. The importance of the Stray cannot be over-estimated, but not the least important of the benefits it has conferred is that, by preventing the crowding together of houses, it has made Harrogate a spacious, open, airy town.

Among the secondary advantages of the place are the golf links, which provide the lovers of that healthful sport with the opportunity of indulging in their favourite recreation. Its proximity to the town, and its fine situation, make it a most valuable acquisition to a health resort.

There are other Spas in England whose names are as familiar as that of Harrogate, and the reasons for this are not far to seek. Their proximity to London in days when travelling was difficult and dangerous made them the favourite resorts of people of fashion at the time, and their frequent mention in the lighter literature of the last century has given them a prominent place in the public imagination which no other spas possess, and will always serve to make them popular. But when we consider the wonderful variety of mineral waters which Harrogate possesses, with the wide range of their therapeutic powers, we need not hesitate to accord it the highest position among the spas of England; while, if we compare it with the Continental spas, it will be found that in some respects it stands unequalled in Europe.

CHAPTER II.

THE CHEMICAL COMPOSITION OF THE MINERAL WATERS.

THE chief characteristics of the Harrogate waters are, first, their number; secondly, their variety, for there are more than eighty springs, all differing from one another in one or more essential particulars; and thirdly, their well-known efficacy in the treatment of certain diseases.

These springs all possess certain properties in common, but there are points of difference, in that some contain one important ingredient, others contain another. Saline ingredients, for example, are present in all of these springs. Again, some of them contain sulphur compounds, while others possess iron compounds. The various springs hold these constituents in different quantities, but the quantity of each ingredient in any one spring is constant. In other words, the same ingredients, and the same quantity of these ingredients, are invariably present in any one given spring. As these springs are thus naturally differentiated from one another, classification is rendered possible and necessary, and this will

in turn facilitate the consideration of their chemical constitution, their pharmacological action, and their therapeutical application.

CLASSIFICATION OF THE WATERS.

It has just been stated that saline constituents are found in all of these waters, but the proportion of saline matter present differs in each spring. In some it is present in large amount, but in others small quantities only are found. We have also seen that sulphur is contained in some of the springs, iron in others. A convenient and practical arrangement, therefore, is to divide the waters into two classes, one for those holding sulphur compounds, and the other for those containing iron salts. These classes are then subdivided according to the strength of the saline constituents. The following classification enumerates and arranges the waters most frequently employed in internal administration:—

CLASS I.—SULPHUR WATERS.

1. *Strong Saline-Sulphur Waters.*

Old Sulphur Well.

Strong Montpellier.

2. *Mild Saline-Sulphur Waters.*

New or Mild Sulphur (Royal pump-room).

Mild Montpellier.

Magnesia.

No. 36

TABLE OF ANALYSES OF THE SULPHUR WATERS.

Constituents in Grains per 20 ounces.	Old Sulphur Well.	Strong Sulphur Mont- pellier.	Mild Sulphur Pump Room.	Mild Sulphur Mont- pellier.	Magne- sia.	No. 36.	Star- beck Well.	Har- low Car Well.
Sodium Sulphide, -	.908	1.82	.86	1.09	.088	.91	.17	.40
Sodium Chloride, .	111.708	103.421	72.86	48.6	26.987	..	14.55	.39
Magnesium Chloride, -	6.035	7.248	.29	3.448	.224	..	..	.68
Calcium Chloride, -	5.454	9.992	2.08	3.912	..	..	..	.16
Potassium Chloride, -	1.199	.601	1.41	.711	3.489	..	..	.06
Barium Chloride, -	.820	..	trace	..	.152	..	trace	..
Strontium Chloride, -	trace	.352	..	.077	trace	..	..	..
Lithium Chloride, -	.094	trace	trace	..	trace	..	trace	..
Ammonium Chloride, -	.128	.124	..	.082	trace	..	trace	..
Magnesium Bromide, -	.285	..	..	..	trace	..	trace	..
Magnesium Iodide, -	.014	..	..	..	trace	..	trace	..
Calcium Carbonate, -	3.721	1.093	..	2.088	2.309	..	1.25	1.31
Magnesium Carbonate,	.744	..	..	..	1.599	..	.43	.14
Potassium Carbonate, -	..	..	..	..	..	..	.08	.06
Sodium Carbonate, -	..	..	..	..	..	..	1.80	1.90
Barium Sulphate, -	..	.052	..	..	..	..	..	..
Strontium Sulphate, -	..	.066	..	.114	..	..	..	..
Calcium Sulphate, -	..	..	..	..	..	..	.23	..
Sodium Nitrate, -	..	.112	..	.046	..	..	..	..
Silica, - - - -	.087	.446	.3	.479	.201	..	.40	.12
Magnesium Sulphate, -	..	..	..	..	..	..	..	.52
Total Solids, -	130.94	125.37	81.85	60.65	35.05	29.9	18.94	5.82
GASES IN CUBIC INCHES.								
Sulphuretted Hydrogen	1.27	..	.52	..	..	..	..	..
Carbon Dioxide, -	5.01	7.5	1.65	6.75	1.43	..	..	..
Carburetted Hydrogen	..	..	..	..	..	..	..	..
Nitrogen, - - -	..	..	..	..	..	..	..	..

3. *Alkaline Sulphur Waters.*

Starbeck Well.

Harlow Car Well.

CLASS II.—CHALYBEATE WATERS.

1. *Strong Saline-Iron Waters.*

Kissingen Well.

2. *Mild Saline-Iron Waters.*

Chloride of Iron Well.

Alexandra Well.

3. *Pure Chalybeate Waters.*

Carbonate of Iron Well.

Tewitt Well.

Harrogate Pure Chalybeate.

John's Spring.

On reference to the tables of the analyses of these waters, it will be seen that they are arranged, not according to the quantity of sulphur or iron present, but that the series begins with that spring which contains the largest quantity of *saline* in solution, and ends with that containing the least. Each of the intermediate wells contains less than that which stands above it.

It would take us beyond the scope of this book to dwell upon the nature of these ingredients; the above tables show what constituents are found in these springs, with the quantity present in each case, and if we briefly consider some of these con-

TABLE OF ANALYSES OF THE IRON WATERS.

Constituents in Grains per 20 ounces.	Kissin- gen Spa.	Chloride of Iron Spa.	Alex- andra Chaly- beate.	Car- b'nate of Iron Spa.	Pure Ch'ly- beate Royal Pump	Tewit Well.	John Well or Old Spa.
Ferrous Chloride, - - -	..	1.737	..	..	..	..	..
Ferrous Carbonate, - - -	1.198	1.452	.722	.755	.170	.169	.158
Calcium Sulphate, - - -	..	..	1.137	.952	.093	.087	.038
Barium Sulphate, - - -	.063	.025	..	..	..	..	..
Potassium Chloride, - - -	2.678	..	.141	.018	..	.165	..
Sodium Chloride, - - -	84.324	34.695	22.046	1.456	.203	.035	.192
Ammonium Chloride, - - -	.054	.050	trace	..	trace	trace	trace
Barium Chloride, - - -	..	.650	..	..	..	..	..
Strontium Chloride, - - -	.110	.078	..	..	..	..	..
Calcium Chloride, - - -	10.917	11.751	..	.288	..	..	..
Manganese Chloride, - - -	..	.121	trace	..	trace	trace	..
Magnesium Chloride, - - -	8.173	7.164	.591	1.643	..	..	..
Lithium, Iodides, Bromides, } Fluorides, - - - }	traces	traces	traces	..	traces	traces	..
Barium Carbonate, - - -	.267	..	..	..	..	..	..
Calcium Carbonate, - - -	1.107	..	1.720	.042	.191	.179	.283
Magnesium Carbonate, - - -	..	..	.723	..	.244	.333	.379
Potassium Carbonate, - - -	..	..	..	..	.032	.132	.123
Sodium Carbonate, - - -	..	..	..	..	.137	..	.167
Silica, - - - - -	.446	.176	.084	.025	.062	.130	trace
Organic Matter, - - -	..	..	.181	..	.093	.082	trace
Total Solids, -	109.34	60.18	27.35	5.18	1.22	1.31	1.32
GASES IN CUBIC INCHES.							
Carbon Dioxide, - - -	2.6	6.66	2.13	..	1.71	1.48	1.86
Oxygen, - - - - }	..	..	..	..	..	..	..
Nitrogen, - - - }	..	..	..	..	..	..	..

stituents, that will be sufficient for the purpose in hand.

Sulphur Compounds.—These occur as sodium sulphide and sulphuretted hydrogen gas. The various waters contain these sulphides in different amounts. The greatest quantity of sodium sulphide, viz. 1.8 grains in a pint, is found in the Strong Montpellier Spring. While the largest amount of sulphuretted hydrogen gas is present in the Old Sulphur Well.

Iron Compounds.—These are found in the ferrous form, both as a carbonate and as a chloride. The carbonate of iron is present in all the waters, but the chloride occurs in one only. The latter is an extremely rare ingredient in iron waters.

Chlorides.—Sodium chloride is a common ingredient in mineral springs, and is by far the most abundant constituent in these waters. In the stronger springs it forms the greater part of the saline ingredients; for instance, in the Old Sulphur Spring, in which there are 131 grains of dissolved solids in each pint, chloride of sodium contributes 111 grains of that amount. In fact, chloride of sodium is so abundant in many of the springs that they may be looked upon as *salt water springs*. Thus, it would be more correct to regard all our springs as compound waters, and to designate them respectively as saline-sulphur and saline-iron springs.

Carbonate and Sulphate of Lime.—When these salts of lime do occur at all, they are present only

SULPHUR WATERS OF OTHER SPAS.

NAME OF SPRING.	Sodium Sulphide—Grains in 16 oz.	Sulphuretted Hydrogen—Cubic Inches.	Most Important Constituents.
Aix-la-Chapelle (Kaiserquelle),	.07	.5	Sodium Chloride; Sodium Carbonate.
Baden (nr. Vienna),	...	.08	Carbon Dioxide.
Burtscheid, . . .	...	.12	Sodium Chloride; Calcium Carbonate.
Bagnères de Luchon, . .	.391	Trace	Sodium Chloride; Potassium Sulphate.
Barèges, . . .	.360	...	Potassium Chloride; Sodium Sulphate.
Schinznach, . . .	...	1.72	Calcium Sulphate; Sodium Sulphate.
Aix-les-Bains, . . .	...	Trace	Sodium Chloride, Potassium Chloride.
Mehadia, . . .	...	.8	Sodium Chloride, Magnesium, Sodium, and Calcium Sulphates.
Uriagr, . . .	...	.09	Sodium Sulphate, Calcium Sulphate, Calcium Carbonate, Calcium Sulphide.
Nennndorf, . . .	...	1.18	Carbon Dioxide, Sodium Carbonate.
Weilbach, . . .	...	.16	Carbon Dioxide.
Langenbrücken, . . .	...	.13	...
Challes, . . .	1.9	...	Calcium, Magnesium, and Sodium Sulphates.
Strathpeffer, . . .	.198	1.12	

in minute quantities. This is a matter of considerable importance, on account of these ingredients being indigestible, and tending to produce constipation.

Carbonic Acid Gas.—Both classes of water contain this gas, but not in any large amount. The sulphur waters, however, hold more than most of the springs of a similar nature found at other spas, many of which exhibit no carbonic acid at all, while in the others only small quantities are found.

TEMPERATURE OF THE WATERS.

All the waters of both classes are non-thermal. They are, however, heated artificially. Special apparatus is employed in heating the waters for internal administration, which is designed to prevent any deposition of the ingredients taking place.

COMPARISON OF THE HARROGATE WATERS WITH THOSE AT OTHER SPAS.

It is useful at this stage to compare the waters with other well-known European springs of a similar nature. To facilitate this, the writer has prepared tables from analyses given in two standard works on balneology.¹ First, if we compare the sulphur waters, it will be seen that Challis is the only spring that has a larger amount of sodium sulphide than

¹ Von Ziemssen, "Handbook of General Therapeutics." Braun, "Curative Effects of Baths and Waters."

IRON WELLS OF OTHER SPAS.

NAME	Iron Carbonate— Grams in 16 oz.	Most Important Constituents.
Carlsbad (Sprudel), . . .	.02	Carbon Dioxide; Sodium Sulphate and Carbonate.
Schwalbach (Stahlbrunnen), . .	.64	Carbon Dioxide.
Marienbad (Ferdinand's Quelle),	.47	Sodium Sulphate, Sodium Chloride, Carbon Dioxide.
Tarasp. (St Lucius), . . .	.165	{ Sodium Bicarbonate, Sodium Sulphide.
Do. (St Emerita), . . .	.163	{ Sodium Chloride, Calcium Carbonate.
Franzensbad (Wiesenquelle), . .	0.37	Sodium Sulphate, Carbon Dioxide.
Kissingen (Ragoczy), . . .	.24	Sodium Chloride.
Homburg (Elizabeth), . . .	.46	Carbon Dioxide.
Stahlbrunnen, . . .	.7	Sodium Chloride, Sulphuretted Hydrogen.
St Moritz, . . .	.18 0.25	Carbon Dioxide.
Orezza (Corsica), . . .	.85	Carbon Dioxide, Calcium Carbonate.
Pymont, . . .	.57	Carbon Dioxide.
Spa (Trinkquelle), . . .	.37	
Muscau (Badequelle), . . .	1.38 3.0	Ferrous Sulphate.

the principal Harrogate springs, and that the others contain very much less. However, Challis has no sulphuretted hydrogen, and the quantity of other constituents is small. Schinznach contains rather more sulphuretted hydrogen than any of the Harrogate waters, but it has no sodium sulphide. Though the Strathpeffer water has rather more sulphuretted hydrogen than the Harrogate waters, its charge of sodium sulphide is small. Indeed, its total quantity of sulphur, estimated from the sulphides, is only equal to that present in our mild waters. Again, the Strathpeffer water has the disadvantage of possessing a fair amount of sulphate and carbonate of lime. It is thus apparent that, among European spas, Harrogate possesses the strongest sulphur waters. It is also to be observed that they are the richest in chlorides, a circumstance, as we shall see later, of very considerable physiological and therapeutical importance. On the other hand, in the great variety of Harrogate sulphur springs, there are some which contain only small proportions of chlorides, a fact of great therapeutical moment, as there are cases for which the stronger waters are not adapted.

If we now turn to the table of iron waters, we find that, with the exception of Muskau, in Northern Prussia, Harrogate possesses in its Chloride of Iron Well, a stronger spring than any other European spa. The waters of Muskau, however, are, on account

of possessing a large charge of sulphate of iron unsuited for internal use. The possession of a large amount of chlorides adds greatly to the value of some of the Harrogate chalybeate waters. Indeed, the Kissingen spring is so richly endowed with chlorides that it may be used as an aperient. This last mentioned spring is unique in the British Isles, in possessing a large quantity of chlorides combined with carbonate of iron.

Thus, to sum up, Harrogate not only stands unequalled among European spas for the number and variety of its mineral springs, but the strength and constitution of these springs give it the *premier* position among those spas possessing springs of a similar nature.

CHAPTER III.

THE ACTION OF THE MINERAL WATERS UPON THE BODY GENERALLY.

WE have seen in the preceding chapter that these waters are richly provided with chemical constituents. The point of interest to us, however, is that some of these constituents occur in amounts sufficiently large to react upon the animal economy. Consequently, the physician has ready to hand a varied array of mineral waters, constant in their strength and constitution, and capable of producing certain effects, and from these waters he may select one or more varieties in the treatment of any particular case.

We shall proceed to consider, first, the action of the waters, and then the action of the principal ingredients.

THE ACTION OF THE SULPHUR WATERS WHEN GIVEN INTERNALLY.

Perhaps the easiest way to arrive at an understanding of the general action of the sulphur waters will be to trace their effects when they are administered in aperient doses. It must, however, be clearly borne in mind that many cases are never submitted

to aperient treatment, for it is almost needless to say, that there are some ailments in which this course would be positively injurious.

When the stronger waters are administered in aperient doses, they are generally followed up during the day by one or more doses of milder water. The total quantity consumed by a patient each day varies from 30 to 50, or more, ounces.

The aperient waters are taken in the morning, before breakfast, and generally produce a slight thirst, which will be relieved by that meal. Immediately after breakfast the bowels are evacuated. Soon after this the patient experiences a feeling of well-being, his spirits rise, he becomes buoyant and exhilarated. Some hours later diuresis occurs, especially if the milder waters are partaken of during the day. If the waters are continued over several days, the appetite improves, and a real desire for, and relish of, food is experienced. Digestion is materially improved. The assimilative processes are augmented. The various biliary functions are stimulated; the bile flows more freely, and the fæces are darkened. This latter effect, probably, is due partly to increase of bile, and partly to the formation of sulphuret of iron. The skin becomes more active, and perspiration is induced. The acidity of the urine is diminished. Sleep is promoted. By careful manipulation the bodily weight may be altered.

These waters have also a powerful and important effect upon the urinary constituents, having a decided influence upon the excretion of urea and uric acid. Now, as their action upon the excretion of these substances gives the key to their action upon the entire organism, it will be instructive to consider the matter with more or less detail. Their action on urea is of consequence, as the amount of that substance excreted is an indication of the amount of nitrogenous tissue change taking place in the system, while their action on uric acid, again, is of importance in connection with the subject of gout. It has long been known, or rather conjectured from clinical observation, and from a knowledge of the pharmacological action of the component parts of the waters, that they have an influence upon the excretion of urea and uric acid, but, so far as is known to me, no carefully conducted investigation had been made to verify this opinion. With the object of ascertaining the exact nature of this action (of the sulphur waters upon the excretion of urea and uric acid), two series of observations were made by me on some of my patients at the Harrogate Royal Bath Hospital. An account of the method pursued, and the results obtained will now be given.

OBSERVATIONS ON THE EXCRETION OF UREA.

Method of Procedure.—Patients were selected whose ailments were of a slight nature. They were uni-

formly dieted throughout, that is to say, they were given the same kind and the same quantity of food and drink from the beginning until the end of the observations. The following was the diet given:—*Breakfast*— $\frac{1}{2}$ lb of bread and butter, $\frac{1}{2}$ pint of tea; *Dinner*—4 oz. of beef, 4 oz. of vegetables, 2 oz. of bread, $\frac{1}{2}$ pint of water; *Tea*—4 oz. of bread and butter, $\frac{1}{2}$ pint of tea; *Supper*—2 oz. of bread, $\frac{1}{2}$ pint of new milk. Some of the patients were kept in bed, and others were allowed gentle walking exercise. Each observation was divided into three parts. First, the patients were placed from four to six days upon the diet just mentioned. Secondly, for a certain number of days the mineral waters were administered to each patient, two 10 ounces of the Old Sulphur Well being given in the morning, and two 10 ounces of Magnesia Water during the day. The waters were then stopped, but the diet was continued for several days. During each stage the urine was collected and measured daily, and the quantity of urea estimated by Hüfner's hypobromite method.

The Results of the Observations.—In every case these results were invariably similar. It was found that during the administration of the waters the quantity of urea excreted was increased in a marked degree. This increase generally was greatest during the first few days, but if the waters were continued for longer than four or five days the amount fell gradually, and continued to fall until the waters were stopped.

The quantity of urea excreted, however, never fell to the average amount obtained *before* the waters were given. When the waters were stopped, the quantity of urea excreted again rose and remained high for four or five days, after which it gradually fell.

The results of one case may be given for the purpose of illustration, but it is unnecessary to multiply instances, on account of the similarity of the results in all the cases.

Case 9. B——.

Average daily excretion of urea.

	In grains.
Before waters,	191
With waters,	305
After waters,	252

Average daily increase of urea.

	In grains.
With waters,	114
After waters,	61

The patient was dieted for five days before the waters were given. These were given for nine days, the diet being continued. Then the waters were stopped, and the diet continued for four days. The urea was estimated daily throughout. It is to be noted that there is a distinct increase in the amount of urea excreted during the administration of the waters. Also that there is much more urea excreted after these are stopped, than was excreted before they were given. It was found in other observations

that the increase quickly diminishes after the fourth day.

In dealing with the cause of this augmented excretion of urea we must take into account, not only the quantity of water ingested, but also the constituents found in the water. It is a well ascertained fact that the consumption of large quantities of water will augment the excretion of urea. But we have seen that in the waters administered, viz., the Old Sulphur Well and the Magnesia Springs, large quantities of chlorides occur, and chlorides too, as we know, influence the amount of urea excreted. Now, we shall find presently that the behaviour of urea, when subjected to the influence of these waters, corresponds entirely with what occurs when large quantities of chlorides are absorbed into the system. We shall leave, therefore, the further consideration of urea excretion until we deal with the action of the chlorides. Thus far we have seen that the saline-sulphur waters have a marked effect upon the nutritive processes. First, we have seen that they aid digestion and assimilation; secondly, that they increase tissue charge; and, thirdly, that they cause the effete products to be freely eliminated.

OBSERVATIONS ON THE ACTION OF THE MINERAL WATERS ON THE EXCRETION OF URIC ACID.

These observations were also made on my patients in the Harrogate Royal Bath Hospital. The same

ACTION OF THE SALINE SULPHUR WATERS ON THE
EXCRETION OF UREA AND URIC ACID.

	Urine in cubic centi- metres.	Uric Acid in grammes.	Urea in grammes.	Remarks.
1892. Nov. 7	960	.548	11.52	Began diet on Nov. 3rd.
„ „ 8	880	.485	11.44	
„ „ 9	525	.451	11.65	
„ „ 10	1450	.604	15.95	Began the administration of waters.
„ „ 11	1350	.571	14.85	
„ „ 12	1525	.553	15.81	
„ „ 13	1575	.423	14.17	Fall begins.
„ „ 14	1175	.379	12.92	
„ „ 15	1670	.348	16.75	Discontinued the waters on evening of this day.
„ „ 16	940	.461	15.98	
„ „ 17	600	.322	11.10	
„ „ 18	870	.479	17.83	
„ „ 19	760	.377	14.44	
Average Daily Excretion.				Uric Acid in grammes.
Before waters were given, . . . .				.495
During the administration of waters, . rise				.576
Do. do. . fall				.383
After waters, . . . . .				.410
				11.53
				15.07
				14.83

diet was given as in the former investigation, except that only 2 oz. of lean beef were allowed instead of 4 oz. The patients were kept in bed during the time the observations were made. The urine was collected and measured each day as before. In estimating the quantity of uric acid excreted, Haycraft's method was followed.¹ First, the patients were kept on the diet from six to ten days. Then the waters were administered for a certain number of days, and the same diet continued. Next, the waters were discontinued, but the diet and estimations were carried on for some days longer. Twenty ounces of the Old Sulphur Well, and twenty ounces of Magnesia Well daily were given.

Results of the Observations.—During the first few days on which the waters were administered, there was generally an increased amount of uric acid excreted. But this increase was only temporary, for the amount excreted soon fell, generally on the third day, to less than what it had previously been before the administration of the waters, and continued thenceforward at the lower level. Next, when the waters were stopped, the quantity of uric acid voided returned to normal. The initial increase, however, did not occur invariably, for in some observations it was found that during the first days there was practically no difference in the quantity of uric acid excreted from what was excreted before the course

¹ *Brit. Med. Journal*, 1885, vol. ii., page 1100.

of the waters was begun. Then within a few days the amount excreted became less, and remained so during the ingestion of the mineral waters. On the cessation of the waters, the excretion of uric acid rose to the original level. The table on the previous page records the results obtained in one case, and will also serve to illustrate what practically took place in most of the observations. It ought to be stated, however, that the decrease in the quantity of uric acid which took place during the course of waters, was sometimes more marked than in the case here recorded.

The question now arises, What does this decrease in the amount of uric acid excreted depend upon? Does it indicate that there is a diminished production? or is it to be accounted for by diminished elimination? If it were due to retention in the system, then we should expect to have an augmented excretion on discontinuing the waters. But, as we have seen, this does not occur. Therefore, we are forced to conclude that the decreased excretion is due to a diminished production of uric acid; and this conclusion is supported by clinical evidence, for no symptoms of retention of uric acid can be observed, but, on the contrary, we find improvement in the condition of those exhibiting the uric acid diathesis. The initial rise in the amount of uric acid excreted during the course of waters to which we directed attention above, is, in all probability, due to an

increased elimination caused by the large quantities of fluid being ingested and voided at the same time. Thus these observations lead to the conclusion that these mineral waters both diminish the quantity of uric acid produced, and also accelerate its elimination. This opinion, we are aware, is opposed to that of Sir William Roberts,¹ whose comprehensive experiments form a valuable addition to our knowledge of the chemistry of uric acid. His experiments with soda salts lead him to conclude that saline mineral springs are unsuited for the treatment of the uric acid diathesis. To quote the words of this writer, "It has been conclusively shown that all salts of soda act adversely on the solubility of sodium biurate (the form in which uric acid is deposited in the body) and hasten its precipitation, and it may be inferred that the introduction of these salts into the circulation must tend to favour uratic deposition in the body." But, with all deference to Sir William Roberts, it may be suggested that the results of his experiments cannot be regarded as necessarily leading to this conclusion. They only go to support the opinion, that biurate of soda is insoluble in certain solutions of soda salts. Before we can arrive at a reliable conclusion, we must regard this complex subject in all its bearings. Among other circumstances, we must not neglect to take into account the action of

¹ The Croonian Lectures on the Chemistry and Therapeutics of Uric Acid, Gravel, and Gout, 1892.

soda salts on the vital processes of the human organism. For instance, we must not overlook their action on the production and elimination of uric acid. But, in arriving at his conclusion, Sir William Roberts has made no allowance for these important processes. Again, in connection with the action of soda salts, Noel Paton¹ found that both salicylate of soda and benzoate of soda diminish the production of uric acid. Without overlooking the influence of benzoic acid and salicylic acid, we may adduce these as examples of *soda* salts resembling the action of these saline waters. And like these saline waters, they are found useful in the treatment of gout. Lastly, we may point out that Sir William Roberts' conclusion is at variance with the clinical experience of those practising at spas possessing saline springs, and is also opposed to the opinion of such eminent authorities on gout as Sir Alfred Garrod and Sir Dyce Duckworth.

The therapeutic interest in the action of these mineral waters on uric acid, lies in the circumstance, that whatever diminishes the production of uric acid, and causes its free elimination, lowers its percentage in the blood and lymph. Hence it follows, that as the saline-sulphur waters possess these actions, they tend not only to prevent uratic deposition, but in addition, to render the blood and lymph more capable of acting upon such deposits, should there be any present.

¹ "The Relationship of the Formation of Urea and Uric Acid to the Secretion of the Bile," *Journal of Anatomy and Physiology*, vol. xx.

PHARMACOLOGICAL ACTION OF THE PRINCIPAL
INGREDIENTS FOUND IN THE SULPHUR WATERS.

The various effects produced by these mineral waters, depend upon the action of the ingredients entering into their composition. Any one effect produced depends upon the action of one or more constituents. At the same time we must recognise that some of the ingredients occur in such small amounts, that they cannot possibly have any action upon the system. We must also remember that large quantities of water have an influence upon the bodily functions.

We shall now consider briefly the pharmacological action of the chief ingredients of the waters, as it will help us to understand the means by which the various results are brought about.

Chloride of Sodium.—As we have seen, chloride of sodium is a constant and abundant ingredient in these mineral waters. It is also present in all the fluids and tissues of the body, and is one of its most important inorganic constituents. For instance, albuminous substances are dissolved by sodium chloride, and may combine with it, globulins requiring a weak solution of it to dissolve them. Again, sodium chloride is also a necessary part of our food, and is essential in the processes of nutrition. When this substance is given in large amount, part of it is quickly absorbed, and should the administration be continued, this is stored up in the

system.¹ Then, should the administration be discontinued, or a reduced amount given, the salt that was stored is eliminated. The storage and the elimination each occupy about three days. Now, when an increased amount of salt is given, there is an augmentation in the quantity of urea excreted. Again, when the quantity of salt usually taken is diminished, there is also an augmentation in the amount of urea excreted. This increase has been explained by Voit as follows :—The osmotic processes between the blood and intercellular tissues are promoted, and the circulation of lymph is increased in rapidity. The effect also is in all probability due to the various albuminous substances having different solubilities in the various strengths of solutions of sodium chloride. Not only, however, is there an increase in the amount of urea excreted by an augmented consumption of chloride of sodium, but there is also an increased excretion of potassium salts. Thus, it is apparent that the augmented consumption of sodium chloride promotes tissue metabolism.

It has already been shown that there is an augmentation in the amount of urea excreted during a course of these waters, followed by another increase on discontinuing them. It is quite evident that this action is similar to that of chloride of sodium, which

¹ Lauder Brunton, "Pharmacology, Therapeutics, and Materia Medica," 3rd edition, pp. 600-601.

no doubt plays a most essential part in augmenting the quantity of urea excreted by the waters. That portion of sodium chloride which is not absorbed, passes into the intestine, and excites peristalsis. In all probability the purgation which follows the use of these waters in a large measure, is due to the action of the unabsorbed portion of chloride of sodium.

Magnesium Chloride.—On account of its low diffusibility, the most of this salt passes into the intestines, where it probably aids the cathartic action of sodium chloride.

Barium Chloride.—Drs Lauder Brunton and Cash found that barium increases the contractile power of muscles, and also, that it increases the blood pressure by stimulating the heart, arteries, and capillaries. In addition, it causes contraction of the involuntary muscles of the intestine and bladder.

Sodium Sulphide and Sulphuretted Hydrogen.—When sulphur is taken into the intestinal canal, it is supposed to be converted into sulphides through the action of the alkalies of the bile, and that intestinal peristalsis is increased thereby.¹ However this may be, the mild sulphur waters taken internally have a tendency to produce constipation. Sulphuretted hydrogen has a reducing action on the blood. The other ingredients, however, in these waters, more than counteract this effect. As regards the reducing

¹ Ringer, "Handbook of Therapeutics," 8th edition, page 131.

action of sulphuretted hydrogen, Esbach found that it converted a strong solution of urates into oxalate of lime.¹ Brunton² thinks that this action may take place in the body. We have already seen that the waters which contain sulphides, diminish the production of uric acid. It is probable that this result is in part due to these, and in part to sodium chloride present in large quantities of water. Both chloride of sodium and water taken in large quantities, are stated to lessen the production of uric acid.

The remaining ingredients entering into the composition of these waters occur in amounts so small, that they probably have little or no action on the bodily functions.

THE ACTION OF THE SULPHUR WATERS WHEN
APPLIED EXTERNALLY.

The sulphur waters are not only administered internally, but they are also applied externally by means of baths and douches. These are usually at a temperature above 96° Fahrenheit. Not only is the skin acted on by baths, the entire system is affected by their use. Hence their importance as therapeutic agents.

In connection with their action on the skin, it may not be out of place to recall to mind the various functions of that important structure. First, it has

¹ *Journal des Connaissances Méd.*, 1883.

² Lettsomian Lectures on Disorders of Digestion, 1885.

a respiratory function, excreting from 60 to 120 grains of carbonic acid, and absorbing about the same amount of oxygen in twenty-four hours.¹ Moreover, it secretes sebum, which serves to keep the skin supple, as well as about two pounds of sweat *per diem*. By means of the skin, gases and other substances may be absorbed into the system. Lastly, it comes into play in regulating the temperature of the body.

To revert to the action of baths, we may state that the warmed sulphur waters have all the effects of an ordinary warm bath, with the superadded action of the sulphur and saline constituents, acting on the skin, the circulatory, muscular, and nervous systems. They also increase tissue metamorphosis.

With regard to the skin, its functions are facilitated by the physical action of heat, and by the constituents of the water. A hyperæmic condition is produced, which withdraws the blood from the internal organs. Sulphuretted hydrogen is absorbed, and carbonic acid given off (Röhrig).² The cutaneous blood vessels contract immediately after a bath, but soon after dressing they again dilate, and perspiration more or less profuse occurs. It is observed that the stronger baths act as a powerful stimulus, and promote, not only the nutrition of the skin, but that also of the

¹ Landois and Stirling, "Textbook of Human Physiology," 4th edition, page 222.

² Landois and Stirling, page 557.

body generally. After a sulphur bath, the skin feels soft, smooth, and velvety, and, when it is harsh and dry, a course of these baths causes it to become soft, smooth, and pliable.

In the case of the muscles, that warm baths have a powerful action on them is a matter of general knowledge. We all know that, if we are fatigued by physical exercise, say at the end of a day's hunting, shooting, or golfing, a warm bath removes the weariness of the muscles, and has a soothing and refreshing effect upon us generally. The removal of waste products is facilitated by the warm bath, and the power of the muscles restored. Again, warm baths increase the excretion of urea. Observations were made by me on patients who were having sulphur baths, and who were at the same time taking the waters internally under the conditions already specified in connection with the observations on the excretion of urea. It was observed that the superadded influence of the baths caused an additional augmentation in the quantity of urea excreted.

Under the influence of warm baths, especially if combined with douches and massage, we find that stiff, swollen, and thickened joints of gouty or rheumatic origin have their size diminished, and their range of movement increased.

The powerful effect of massage in restoring the contractility of exhausted muscles, ought not to pass

unnoticed. Zabłudowski¹ found that rest alone had very little restorative effect, while on the other hand, under the influence of massage, the muscles quickly recovered their power by the removal of effete products. In addition to massage, other auxiliaries, such as electricity, are called into operation in external treatment.

THE ACTION OF THE CHALYBEATE WATERS.

The table of analysis of the Chalybeate waters shows that they all contain ferrous carbonate, and that one contains ferrous chloride in addition to ferrous carbonate. The table also shows that some of these wells possess a considerable quantity of salines which occur chiefly as chlorides.

That the solutions of iron occur in the ferrous form, is a fact of no little therapeutical interest, because ferrous salts form soluble compounds with albuminous substances, differing essentially in this particular from ferric salts, which precipitate them. Again, as has been shown by Bubnow,² ferric salts, during their passage through the alimentary canal, are converted into the ferrous form. Moreover, the carbonate of iron dissolved by the aid of carbonic acid, the form which occurs in these springs, is considered by many to be the form most easily

¹ Centralbl. f. d. med. Wiss., 1883. No. 14.

² Quoted by Stockman, *British Med. Journal*, 1893, vol. i., page 943.

absorbed. It is obviously a significant and important circumstance that we have prepared for us, by nature, that form of iron which is considered to be the most efficacious in the treatment of certain blood degenerations. Then the large quantities of water imbibed, as well as the solutions of salines, have also an influence of some consequence, since they increase tissue change.

The foregoing considerations are in harmony with clinical experience. For this teaches us that these waters have tonic properties, and that they act both as blood restoratives and as alteratives. We find that during the administration of the waters there is an increase in the number of red blood corpuscles, and in the amount of hæmoglobin. Further, we observe that they improve the nutrition of the body, by increasing the appetite, and aiding digestion and assimilation. They improve nutrition also by increasing tissue change, and freely eliminating the effete products. As might be surmised, these waters prove of great value in anæmia and in debility, whether the latter be general, or confined to one or more systems, such as the digestive or nervous.

Aperient properties are possessed by the Kissingen well, in addition to those due to the chalybeate charge. This spring is of extreme value to debilitated patients, who require a course of aperient water. Gouty subjects, for instance, with symptoms of cardiac debility or albuminuria, find this a very useful saline

aperient. Another valuable water is the Chloride of Iron Well. It is peculiarly efficacious in chlorosis, and in cases of enlarged lymphatic glands. Beneficial results of a striking character are produced by it, and these frequently occur very rapidly.

The quantity of iron in these waters merits some consideration, as it may be urged by some that the amount is not sufficiently large for the treatment of such cases as chlorosis. There is, however, a growing opinion that in the treatment of that disease only small doses are necessary. In his valuable paper on "The Treatment of Chlorosis by Iron and some other Drugs,"¹ Stockman says that he found small doses (1 to 2 grains of reduced iron, or carbonate of iron, two or three times a day) to be quite satisfactory. In the records given of some of his cases, two grains of reduced iron were used, and with this quantity the number of red blood corpuscles and the percentage of hæmoglobin quickly increased. Now, if we refer to the analysis of the iron waters, we observe that in 20 oz. of chloride of iron water, there are 1.5 grains of carbonate of iron, and 1.7 grains of chloride. Since 20 oz. to 30 oz. daily of this water are sometimes taken, a patient receives from 3 to $4\frac{1}{2}$ grains of ferrous salts. Therefore it is evident that this amount agrees with what is sometimes given when a patient is treated by the ordinary therapeutical methods. But, which is of even more importance, the satis-

¹ *British Medical Journal*, 1893, vol. i., page 943.

factory results obtained show that this amount is amply sufficient.

Although observation proves that these iron waters of themselves produce valuable results, we must not neglect to point out that they have important auxiliaries in the salines contained in them. Nor must we pass unnoticed the part played by the bracing climate, and all the other influences of a health resort. These various actions are all interwoven one with the other, and all tend to the restoration of the health of the patient.

CHAPTER IV.

THE THERAPEUTICS OF THE MINERAL WATERS AND CLIMATE OF HARROGATE.

THERE are still to be found some persons who are inclined to be sceptical as to the value of mineral waters, and who cavil at any claims put forward on their behalf as remedial agents. We admit that there is some excuse for this feeling. It is partly to be accounted for as the natural reaction against the extravagant pretensions of certain advocates of balneotherapeutics, and partly it is due to the circumstance that the mode of action of the various agencies employed cannot in all cases be satisfactorily explained. But this latter objection ought not to be regarded as insuperable. It is no argument against the use of a remedy which has been incontestably proved to be beneficial, that we are not thoroughly acquainted with the mode of its action. To persist in an attitude of doubt in the face of overwhelming evidence to the contrary, may be as unreasoning as the action of those who proceed to the opposite extreme, and regard the waters as mysterious agents which always work for good, but of the mode of

whose action no rational account can be given. Moreover, whatever objections have been raised in the past on the score of our ignorance on this head, can no longer be considered valid. Balneotherapeutics has been placed upon a scientific basis by investigations into the action of mineral waters as medicinal agents, while the action of the various modes of treatment has now been satisfactorily explained, and their employment scientifically justified. It would be too much to say, of course, that the science of balneotherapeutics has rendered up all its secrets; there still remain obscure questions, and we can only look to time to elucidate them all.

Before proceeding to a consideration of the therapeutics of our mineral waters, we must clearly understand that their action is materially aided by external causes. We cannot afford to overlook the effect produced by the new environment of the patient, which co-operates in no slight degree with the more direct action of the waters in bringing about an improvement in his health. In short, we must recognise the effects of these new circumstances in his surroundings which are popularly described in the words "a change." The atmospheric conditions of the patient, involving barometric pressure, temperature, and humidity, are different; the scenery around him is different; his diet is different; the company he meets is different. He finds himself in the midst of a society suited to his condition. He

is surrounded by persons who are devoted for the time to the common object of gaining health and strength, and the congenial society and surroundings all contribute to the work of restoration. The absence of everything which is calculated to excite or disturb this repose is of the utmost benefit in cases of nervous exhaustion, which the fever and fret of modern life have made only too common amongst us, and is indeed an essential condition of recovery. The mind has great influence over the body, and absolute repose following on protracted mental strain is always attended with salutary effects on the health of the body.

Physical exercise is another factor of importance. The amount of this must be carefully regulated and adapted to the nature of the case, and the treatment which the patient is undergoing. The mildest form of physical exercise is in many instances sufficient, but there are cases when it may be necessary to indulge in a considerable amount of bodily activity in the open air. One whose life has been full of distraction, and who is suffering from debility and nervous exhaustion, requires quietude to restore the balance of health. Another, who has a good physique and is capable of great muscular activity, has been leading a sedentary life, harassed by professional cares, and as a result his brain is exhausted, and he is depressed, irritable, and sleepless. Such a one must take plenty of exercise in a pure invigorating

atmosphere, and his nervous system will be soothed, his mind calmed, his cheerfulness restored, and sleep with all its attendant blessings will be induced.

Again, dietetic treatment is an element of some consequence. In most cases, restrictions in diet require to be imposed. As a general rule the injunctions of the bath physician are implicitly carried out, partly because such advice is more easily obeyed when the patient is away from his usual influences, and partly because he is willing to devote himself solely to treatment. This cursory survey thus shows how various factors may materially assist the action of the waters and baths.

Balneotherapeuties *per se*, consist in both the internal and external use of mineral waters. We have shown that in Harrogate there are many different kinds of waters which are administered both internally and externally; and that when employed externally they may be used generally or topically by a variety of methods, assisted by several agencies such as massage and electricity. As treatment progresses, it may be necessary to pass from one series of waters to another, and from one mode of external application to another. These are matters, however, that are arranged by the bath physician, after consideration of the merits of each particular case. In some cases bath treatment is combined with ordinary medicinal remedies.

We must now pass on to consider the conditions

which derive benefit from treatment by these waters. In doing so we must recall to mind their important action on nutrition, because much of their value depends upon it; in reality, we may regard it as the corner-stone of our balneotherapeutics. In the first place, the waters aid the digestive and assimilative processes; in the next place, they greatly augment tissue change; and lastly, they cause a free elimination of effete products. These various actions establish healthy nutrition, and improve the tone of the whole system. By these means the recuperative powers are stimulated, and the balance between waste and repair is adjusted.

The special and peculiar value of these waters consists in their action on morbid conditions of a *chronic* nature. These derangements may have arisen gradually, or may have succeeded an acute attack of disease, and they may be general or localised. Among these conditions we may include impeded convalescence and general debility. The mineral waters influence all these conditions by their action on the whole system, but we may have superadded a localised, and sometimes a general effect, when external applications are also employed. Clinical evidence proves, that in the long series of chronic derangements, there are very many beneficially influenced by these waters, while many others are completely cured. Since they augment tissue change by their action on the solubility of albuminous

substances, they influence pathological deposits, for example, such as occur in enlarged lymphatic glands, and effect the absorption of these morbid products. Of this action on such deposits we have abundant clinical evidence.

There are many persons to whom a course of these waters is of great benefit. A patient may have no organic disease, but he may have indulged too freely in the pleasures of the table. Another may be abstemious and live carefully, but may have some slight constitutional defect, such as insufficient tone in his digestive organs. In either case there are produced imperfect products of digestion, which irritate the liver, and obstruct the flow of blood through the hepatic vessels. This produces engorgement of the blood vessels of all the digestive organs, and leads to further interference with digestion. Thus, as Lauder Brunton has pointed out, a "vicious circle" is established in the system.¹ Now, aperient doses of these waters break this vicious circle. They flush out daily the alimentary canal, carrying away these imperfect products of digestion. The biliary circulation is also cleared of its poisonous products, and, *pari passu*, the congestion of the alimentary organs is relieved. Moreover, since the administration of the waters is prolonged over a period of time, tone is also given to the digestive

¹ Lettsomian Lectures on Disorders of Digestion, their Consequences and Treatment, 1885.

organs, and effete products are eliminated by other channels.

The internal administration of these waters may be prolonged over many weeks. Indeed, they may sometimes be given advantageously for two or three months, the patient meanwhile gaining in health and strength. In this respect they exhibit a marked superiority to the sulphate springs of other spas, where, on account of the reducing action of the waters, it is injurious to continue their use over a lengthened period. Again, chlorides increase the amount of urinary constituents, while sulphates do not. Matthew Hay, in his elaborate researches into the action of saline cathartics, found that "the effects of sulphates on the excretion of urea is either *nil* or extremely small."¹ The writer worked in the laboratory under Professor's Hay's direction, during the time many of these experiments were made, and through this fortunate circumstance he became familiar with the valuable results of these experiments.

As regards the time of year best suited for the treatment of cases by the waters and baths, it is generally found that cases of gout and rheumatism are most satisfactorily treated during the summer and autumn months, and that all other ailments may be treated during any time of the year. It ought to be stated, however, that many patients who resort

¹ *Journal of Anatomy and Physiology*, vol. xvii., 1883.

regularly to Harrogate, prefer to undergo their course of treatment during the warmer months.

The writer has now briefly considered the composition of these waters, and dealt with the salient features of their action. It only remains for him to give an enumeration of the maladies which are favourably influenced by them.

ENUMERATION OF DISEASES BENEFITED BY THE MINERAL WATERS AND CLIMATE OF HARROGATE.

The diseases which usually derive benefit will now be grouped together, according as they affect one or other system, *e.g.*, diseases of the alimentary system, and the various diatheses will be mentioned separately. Brief observations will then be made on the treatment of some of the maladies. Lastly, contra-indications will be given when it is considered necessary to do so.

I. Diseases of the Alimentary System.

(Chronic dyspepsia; chronic catarrh of the stomach; atony of the muscular coats of the stomach and bowels; chronic intestinal catarrh; functional derangement of the liver; fatty infiltration of the liver; jaundice; hæmorrhoids.)

These mineral waters are especially efficacious in the treatment of derangements of the digestive organs. The aperient waters, for instance, are of

value, since they flush out the alimentary canal daily, and thus remove injurious substances formed during digestion, as well as indigestible products. Again, both the strong and the mild waters increase the appetite, and improve the processes of digestion and assimilation.

Chronic Catarrh of the Stomach.—Patients suffering from this ailment, especially when they have been in the habit of eating and drinking too much, derive considerable benefit from a course of the saline-sulphur waters. Such patients frequently have portal obstruction associated with the catarrh, and aperient doses of the waters quickly relieve this condition.

Chronic Intestinal Catarrh.—This condition may be accompanied either with constipation or diarrhœa. It may also be associated with impeded portal circulation and catarrh of the stomach. The aperient waters are useful when constipation exists, and the mild waters when there is diarrhœa.

Jaundice.—This is favourably influenced, especially when it depends upon duodenal catarrh. The waters relieve the catarrhal condition, and cause a free flow of bile into the intestine. Sometimes it is marvellous how quickly the waters eliminate the bile pigment from the tissues.

Chronic Dyspepsia.—The various forms of dyspepsia are benefited by both the mild sulphur waters and the iron waters. It is necessary in many cases to give the waters cold.

Hæmorrhoids.—When the hæmorrhoidal condition is accompanied by constipation and a general hyperæmic state of the abdominal viscera, it is relieved by the daily evacuation of the bowels. At the same time the condition is advantageously influenced by the improved tone produced in the blood vessels and the muscular fibres of the bowel.

Climate.—All the above mentioned derangements are improved by the climate.

II. *Diseases of the Respiratory System.*

(Chronic pharyngitis; laryngeal catarrh; nasal catarrh; chronic bronchitis; pulmonary tuberculosis.)

In the summer and autumn months the climate proves very beneficial in these conditions. Some of these ailments, more especially if they are complicated by digestive disturbance, are improved by a course of the waters and baths. By their means the digestion and nutrition are improved, and at the same time the respiratory mucous membrane takes on a healthier action. Inhalations and sprays prove useful in some of these maladies. Cases of chronic phthisis are improved during the warm months by the climate, which raises the tone of the whole system. Occasionally, one of the mineral waters may be given internally.

Contra-indications.—Those suffering from diseases of the respiratory system should not be sent during the winter and spring, since the cold dry winds

which prevail during those months are apt to aggravate the symptoms.

III. *Diseases of the Heart.*

The condition of the heart requires to be considered before deciding upon a course of treatment for a patient. It may be stated that, as a rule, baths may be given in affections of the heart if there be no failure of its action, or if the failure is only slightly marked. When valvular lesions occur, baths carefully given occasionally aid the natural efforts to establish compensation; and the waters given internally prove useful in the treatment of the complications which arise in valvular disease. Cases of articular gout and chronic rheumatism, complicated by such a condition of the heart as precludes the use of length baths, may be treated by topical applications, such as douches. Irritability of the heart and palpitation are sometimes benefited by the tonic waters.

IV. *Diseases of the Nervous System.*

(Neuralgia; peripheral neuritis; local functional spasm; progressive muscular atrophy; locomotor ataxia; neurasthenia; hypochondriasis; hysteria; chorea.)

Not only the waters and baths, but the dry bracing atmosphere, proves efficacious in some of these conditions. Massage is a very useful auxiliary in

treatment. Douches combined with the continuous current occasionally give good results in local functional spasm, such as writer's cramp. In progressive muscular atrophy, if the muscles are not seriously affected, the disease may be arrested by douches and the interrupted current. Considerable success is obtained in neurasthenic patients by the tonic waters, combined with douches and massage. The symptoms in locomotor ataxia are frequently alleviated.

V. *Diseases of the Sexual Organs.*

1. *In the female.*—(Chronic metritis; chronic endometritis; menorrhagia due to these and other causes; various functional derangements.)

The administration of the waters and the employment of douches and massage are frequently followed by amelioration of the patient's condition. The treatment not only improves the digestion and nutrition, but tends to absorb some of the pathological products which occur in certain of the derangements of the female sexual organs. The climate and the baths are of service after operations on the genital organs.

2. *In the male.*—There is a form of prostatic enlargement associated with constipation and rectal congestion. The condition causes a feeling of weight and uneasiness in the perineum. The aperient waters relieve the constipation and rectal congestion,

and this is followed by a decrease in the size of the prostate, and a corresponding alleviation of the symptoms of the patient.

VI. *Diseases of the Urinary Organs.*

In these conditions the patient's health is improved by the climate and mineral waters. The kidneys and urinary passages are at the same time flushed daily by a large quantity of water. The saline-sulphur and the chalybeate waters both prove useful in diseases of the urinary organs.

VII. *Diseases of the Skin.*

(Eczema; psoriasis; pruritus; prurigo; urticaria; acne; lupus; lichen; sycosis; diseases of the sweat glands; ichthyosis; general exfoliative dermatitis.)

The Harrogate waters are extremely useful in the treatment of skin diseases, and many hundreds of cases are successfully dealt with every year. The recoveries are still more remarkable and striking, when we take into account the fact that the majority of the cases come here, because their symptoms have not yielded to the ordinary therapeutic means.

Eczema derives considerable benefit from the combined effects of the baths and waters. The baths in these cases, however, require great care and constant supervision. Various local applications may be combined with the waters. The form of eczema which begins acutely, and which is dis-

tributed all over the body, with marked congestion and swelling of the skin, and with profuse exudation, recovers very rapidly under the influence of the baths and waters. Gouty eczema also recovers quickly.

Psoriasis.—This is benefited for the time, but as in other methods of treatment, the eruption is liable to return.

Lupus.—The baths and waters lessen the congestion of the skin, and improve the general condition of the patient, thus rendering his state more favourable for successful local treatment. The salicylic plasters recommended by Unna, combined with the baths, give good results. The carbolic plasters suggested by me are also useful, combined with the baths and waters, especially if the skin be delicate.¹

Sycosis.—In this disease the patient is generally in a depressed state of health. Under the influence of the waters nutrition is improved, and occasionally without further treatment the disease disappears.

Ichthyosis, when it is localised, is improved, and a healthier condition of the skin is induced.

Contra-indication.—Cases of eczema of the face ought not to come in the early months of the year.

VIII. *Chronic Gout.*

A large contingent of those who come to Harrogate for treatment, are suffering either from gout or

¹ *British Medical Journal*, 1892, vol. ii., p. 999.

rheumatism. Many patients are in the habit of undergoing a course of the waters once or twice a year. Now it is an eloquent testimony in favour of the efficacy of these waters, that patients suffering from these ailments come year after year, not only because they obtain relief during the time of treatment, but also because they feel by this means they are enabled to get through the other portions of the year with greater comfort. In this respect these saline waters are much more valuable than indifferent and alkaline waters, which simply affect the existing symptoms, but have no power to prevent their return.

Cases of chronic gout, whether of a regular or an irregular type, are generally subjected to both internal and external treatment. The latter plays in articular gout an important part in the form both of ordinary baths, and of douches and massage, all of which are extremely useful. By the combined influence of these agents, stiff and swollen joints are diminished in size, and their range of movement increased. Stiffness in tendons also is relieved. There is, however, no appreciable change in uratic deposits.

The various manifestations of irregular gout are favourably influenced by the waters. As we have seen (page 28), they aid the elimination of uric acid, and diminish its production, and moreover, they influence the various bodily functions. Among the beneficial effects produced are an increased activity

of the kidney and skin, and a restoration of the normal functions of the liver.

Gout in the *bon-vivant* is very amenable to this treatment, as it relieves the hepatic and other digestive disturbances, and also causes the gouty symptoms to disappear. Lithiasis is relieved by the use of these waters.

Contra-indications.—When gout is complicated by grave cardiac or renal mischief, it is unsuited for this treatment, though some cases derive benefit from the milder waters during the warm months. Old people who are infirm are not suitable subjects for mineral water treatment, except this be carried out in a very modified form.

IX. *Chronic Rheumatism.*

Under this head are included cases of chronic rheumatic arthritis, rheumatoid arthritis, muscular rheumatism, painful affections of fasciæ and other fibrous tissue, sciatica (some cases of which are considered to be due to rheumatism).

We have just stated, under gout, how valuable these waters are in that disease, and in rheumatism, and mentioned how highly they are appreciated by patients suffering from these maladies. In the rheumatic conditions just enumerated, external treatment, as a rule, yields the best results. The various warm baths and appliances subdue the inflammatory condition, and restore mobility to the part. As in

gout, the whole array of external appliances may be called into operation. A preliminary course of aperient waters, however, followed by some of the mild waters, often does good by improving the general health. It is important to remember that the cold months of the year are not suited for the treatment of these cases.

X. *Constitutional Syphilis.*

Sometimes it is asserted that mineral water treatment has little or no influence on this disease. This opinion, however, is contrary to the experience of those who practise at this Spa, since it is found that very satisfactory results are obtained by the treatment. In fact, some cases in which the symptoms have lingered, on being submitted to our mineral water treatment, have quickly recovered, and this occurs sometimes without the aid of anti-syphilitic remedies. Doubtless this effect is produced by the waters establishing healthy nutrition, and enabling the natural powers to grapple with the disease. Skin eruptions rapidly disappear, the skin being stimulated to healthy action by the ingredients in the water, as well as being influenced by the warm baths. Mineral water treatment, combined with mercurial inunction, proves very efficacious. Perhaps this is partly due to the fact, that warm baths increase the activity of the skin, and cause it to absorb the mercury more quickly. Voit states that

the mercurial globules pass into the hair follicles, and the ducts of the glands, and that their secretion converts them into absorbable compounds. Some consider that the sulphur ingredients have a specific action, but upon this point we have no reliable information.

XI. *Anæmia.*

We occasionally find that, in chlorosis and other anæmic states, the ordinary medicinal remedies produce no improvement in the condition of the blood. The reason for this is still an open question. Probably one cause is failure of the assimilative power. Such cases, when undergoing a course of our chalybeate waters, frequently show rapid improvement in the state of the blood. This improvement is probably initiated by assimilation receiving an impetus from the action of the water. The climate, too, has a remedial influence. Occasionally it is advisable to prescribe a preliminary course of one of our aperient waters, either a saline-sulphur or the Kissingen.

The Kissingen is of great value in these cases, as it combines both aperient and chalybeate properties.

XII. *Chronic Metallic Poisoning.*

The mineral water treatment is of considerable value in lead poisoning and mercurialism. By its

means, not only is the metal eliminated, but the morbid conditions produced by it are alleviated.

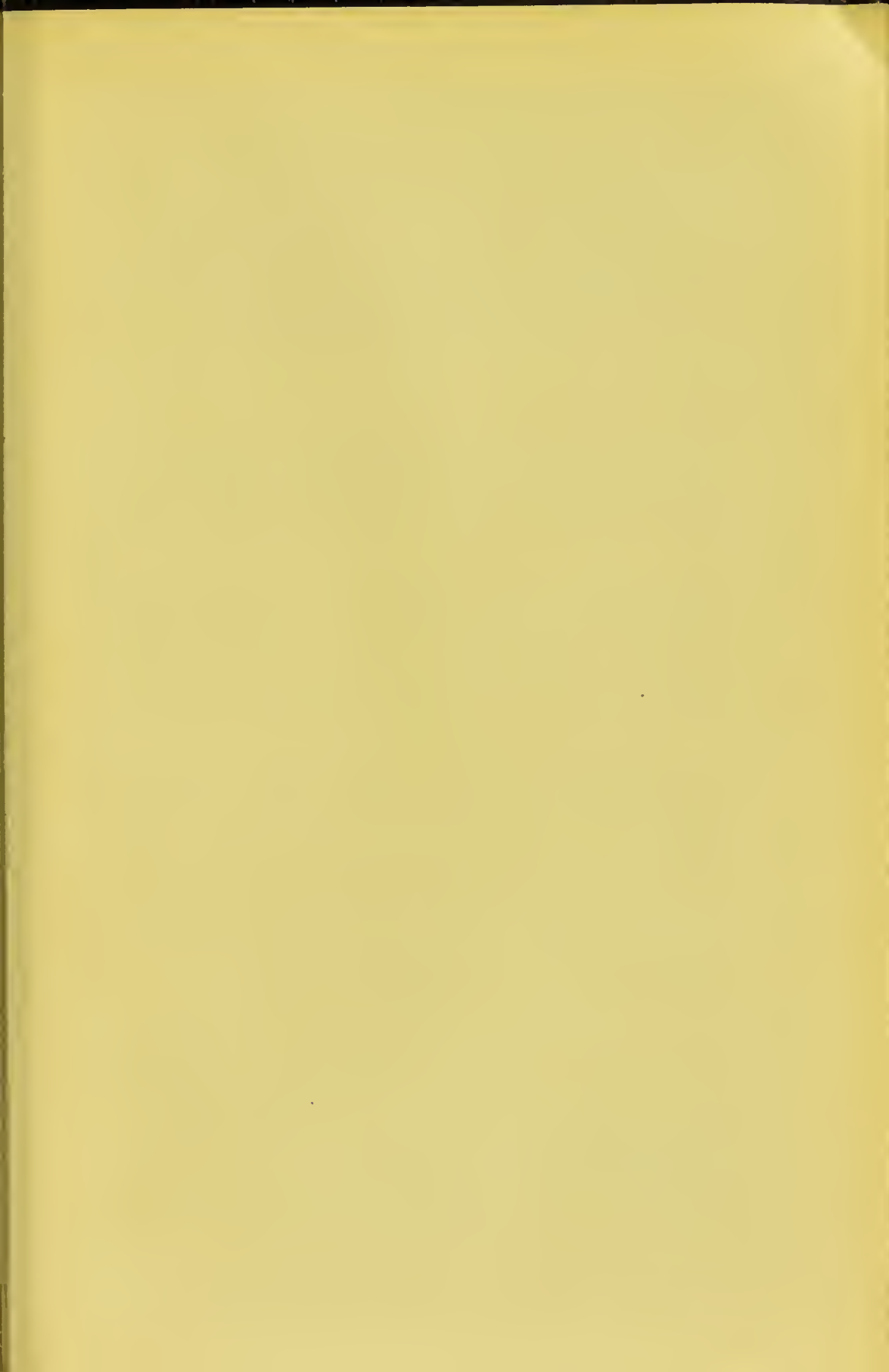
It is supposed that, in these conditions, the metal is deposited in the body in the form of an albuminate. If this opinion be correct, then the chlorides will be of use on account of their action on the solubility of albuminous substances, and on the processes of osmosis. Warm baths aid, too, in the elimination of the metals.

Since lead is eliminated principally by the mucus of the intestine, it is reasonable to suppose that the sulphides occurring in the mineral waters unite with it when it arrives in the intestine, the insoluble sulphide thus formed being speedily got rid of by the aperient action of the waters.

XIII. *Scrofula.*

The various manifestations of this diathesis are favourably influenced both by the waters and by the climate, each tending to improve nutrition. The sulphur and the chalybeate waters are both serviceable in this diathesis. We find that the skin affections, the catarrhal conditions of the bronchi and intestine, and inflammations of the mucous membranes around the natural orifices, which depend on scrofulous habit, are all ameliorated by the waters. We frequently see a rapid and remarkable reduction take place in enlarged lymphatic glands. It is a matter of interest to note that calcium chloride

exists in some of these waters in quantities equal to the ordinary medicinal dose. This ingredient, as is well known, is highly esteemed by some in the treatment of enlarged lymphatic glands.





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